

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 5/17/21**

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 5/17/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

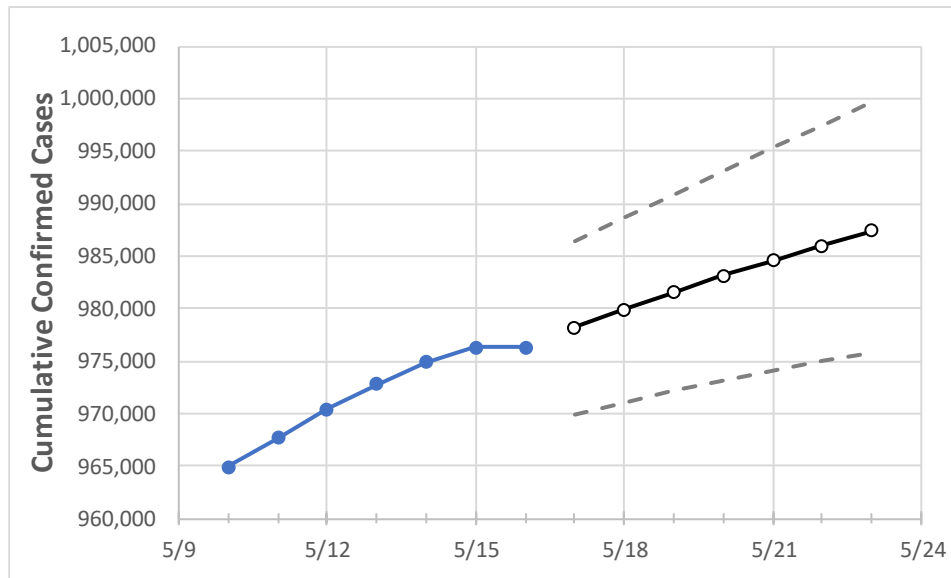
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Michigan State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23
Michigan	972,746	974,848	976,339	976,339	978,165	979,888	981,556	983,126	984,592	986,004	987,367

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Michigan Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23
Genesee	41,001	41,064	41,098	41,098	41,156	41,212	41,261	41,310	41,355	41,398	41,439
Ingham	24,310	24,358	24,388	24,388	24,421	24,454	24,484	24,513	24,542	24,568	24,594
Kent	70,896	71,069	71,191	71,191	71,332	71,472	71,604	71,729	71,856	71,978	72,097
Livingston	16,358	16,387	16,411	16,411	16,436	16,459	16,482	16,502	16,522	16,542	16,560
Macomb	97,927	98,081	98,195	98,195	98,334	98,464	98,593	98,712	98,824	98,933	99,039
Monroe	15,045	15,081	15,096	15,096	15,120	15,143	15,166	15,186	15,206	15,226	15,245
Oakland	115,741	115,982	116,183	116,183	116,434	116,668	116,903	117,134	117,354	117,561	117,772
Washtenaw	26,039	26,070	26,101	26,101	26,132	26,161	26,189	26,216	26,240	26,264	26,288
Wayne	160,985	161,335	161,531	161,531	161,811	162,076	162,328	162,574	162,808	163,026	163,225

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Michigan Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	5/13	5/14	5/15	5/16	5/18				5/20				5/22			
Genesee	41,001	41,064	41,098	41,098	41,212	(8,242)	[1,978]	{989}	41,310	(8,262)	[1,983]	{991}	41,398	(8,280)	[1,987]	{994}
Ingham	24,310	24,358	24,388	24,388	24,454	(4,891)	[1,174]	{587}	24,513	(4,903)	[1,177]	{588}	24,568	(4,914)	[1,179]	{590}
Kent	70,896	71,069	71,191	71,191	71,472	(14,294)	[3,431]	{1,715}	71,729	(14,346)	[3,443]	{1,722}	71,978	(14,396)	[3,455]	{1,727}
Livingston	16,358	16,387	16,411	16,411	16,459	(3,292)	[790]	{395}	16,502	(3,300)	[792]	{396}	16,542	(3,308)	[794]	{397}
Macomb	97,927	98,081	98,195	98,195	98,464	(19,693)	[4,726]	{2,363}	98,712	(19,742)	[4,738]	{2,369}	98,933	(19,787)	[4,749]	{2,374}
Monroe	15,045	15,081	15,096	15,096	15,143	(3,029)	[727]	{363}	15,186	(3,037)	[729]	{364}	15,226	(3,045)	[731]	{365}
Oakland	115,741	115,982	116,183	116,183	116,668	(23,334)	[5,600]	{2,800}	117,134	(23,427)	[5,622]	{2,811}	117,561	(23,512)	[5,643]	{2,821}
Washtenaw	26,039	26,070	26,101	26,101	26,161	(5,232)	[1,256]	{628}	26,216	(5,243)	[1,258]	{629}	26,264	(5,253)	[1,261]	{630}
Wayne	160,985	161,335	161,531	161,531	162,076	(32,415)	[7,780]	{3,890}	162,574	(32,515)	[7,804]	{3,902}	163,026	(32,605)	[7,825]	{3,913}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.